# AREI UPDATES: Agricultural Research

***Updates on Agricultural Resources and Environmental Indicators***

Natural Resources and Environment Division
Economic Research Service, U.S. Department of Agriculture

1995
Number 5

## Private Research Continued Faster Growth than Public Research in 1992

- **The private sector spent more than $3.7 billion for research on food and agriculture in 1992, compared with Federal expenditures of $1.5 billion and state government expenditures of $0.98 billion.**

- **Over 38% of Federal expenditures for agricultural research in 1992 went to State Agricultural Experiment Stations (SAES) and cooperating institutions.**

- **Private expenditures for agricultural research have been increasingly directed to agricultural chemicals research, rising from 13% of the total in 1960 to 37% in 1992, and to plant breeding research, rising from 3% in 1960 to 12% in 1992.**

- **USDA grants in 1992 to SAES in the form of formula funds, competitive grants, special grants, and cooperative agreements funded 16% of SAES research.**

Since the 1980's, the private sector has surpassed the public sector in agricultural research expenditures. Private industry also provided $143 million in funds to SAES and cooperating institutions in 1992.

Research by agricultural inputs industries has grown faster than that by food and kindred products industries. Within input industries, research on chemical and biological innovations has grown faster than that for mechanical innovations.

The distribution of public research expenditures across research goals has not changed markedly since 1973. Goals of cost reduction, pest and disease protection, and natural resource management accounted for 69% of the total in 1992.

SAES receive research funds from multiple sources, and individual states vary widely with respect to their reliance on alternative funding sources. Overall, state appropriations are the major source of SAES funds, followed by the Federal government, and then industry and other non-governmental sources.

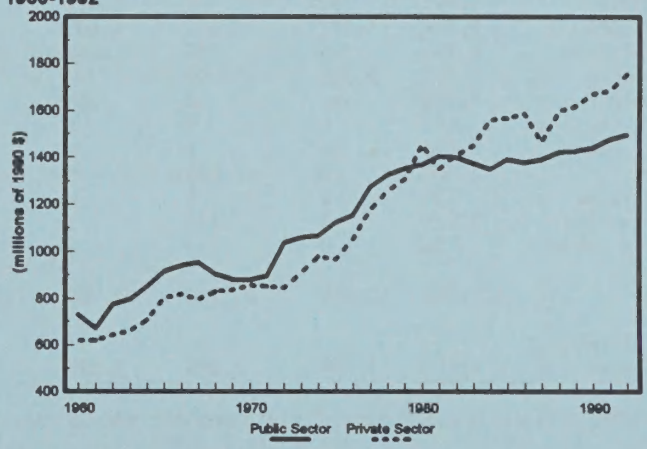
Texas is the largest recipient of USDA grants, ranking either first or second in each category. Ten states rely on USDA formula funds for over 74% of their USDA grants. USDA competitive grants are only 1.7% of total funds to SAES. California, Texas, New York, and Wisconsin are the leading recipients of competitive grants.

Contact: Keith Fuglie (202) 219-0408, Kelly Day (202) 219-0331, or George Frisvold (202) 219-0416.

### About AREI UPDATES

**AREI UPDATES** is a periodic series which supplements and updates information in **Agricultural Resources and Environmental Indicators (AREI)**, USDA, ERS, AH-705, Dec. 1994. **UPDATES** report recent data from surveys of farm operators and others knowledgeable about changing agricultural resource use and conditions, with only minimal interpretation or analysis. Please contact the individual listed at the end of the text for additional information about the data in this **UPDATE**. If you would like to be added to the mailing list or have other questions about **AREI UPDATES** or **AREI**, contact Richard Magleby, (202) 219-0436.

**Figure 1 – Expenditures for agricultural research in the U.S., 1960-1992**




Expenditures deflated by R&D price deflator (see table 2).
Source: USDA, Inventory of Agricultural Research; and ERS, unpublished data.

Table 1--Funding of State agricultural experiment stations and cooperating research institutions, by funding source, 1992

| | USDA formula funds | USDA competitive grants | USDA special grants | Other USDA grants | Other Federal grants | State appropriations | Industry/ other[a] | Product sales | Total[b] |
|---|---|---|---|---|---|---|---|---|---|
| | Thousands 1992 dollars | | | | | | | | |
| Alabama | 7,361 | 516 | 887 | 758 | 1,356 | 19,883 | 9,113 | 4,115 | 43,989 |
| Alaska | 1,269 | 0 | 80 | 0 | 512 | 3,473 | 919 | 0 | 6,253 |
| Arizona | 2,083 | 746 | 82 | 2,157 | 8,246 | 20,293 | 14,318 | 1,668 | 49,593 |
| Arkansas | 5,116 | 83 | 2,598 | 854 | 942 | 18,148 | 6,319 | 0 | 34,060 |
| California | 5,674 | 4,996 | 1,806 | 4,162 | 26,420 | 107,276 | 47,696 | 3,401 | 201,431 |
| Colorado | 3,028 | 567 | 465 | 3,084 | 20,095 | 8,862 | 35,434 | 8,055 | 79,590 |
| Connecticut | 1,879 | 129 | 436 | 442 | 683 | 6,055 | 1,908 | 56 | 11,588 |
| Delaware | 1,819 | 74 | 65 | 196 | 242 | 5,057 | 2,806 | 446 | 10,705 |
| Florida | 4,391 | 1,539 | 2,156 | 1,866 | 8,071 | 61,460 | 21,981 | 0 | 101,464 |
| Georgia | 6,764 | 1,128 | 968 | 1,347 | 1,806 | 40,138 | 6,372 | 0 | 58,523 |
| Hawaii | 1,309 | 84 | 2,668 | 1,308 | 2,337 | 12,897 | 5,134 | 43 | 26,168 |
| Idaho | 2,370 | 162 | 907 | 1,465 | 860 | 11,606 | 4,170 | 1,046 | 22,586 |
| Illinois | 5,459 | 1,711 | 805 | 786 | 4,401 | 17,355 | 20,459 | 5,109 | 56,085 |
| Indiana | 4,939 | 511 | 272 | 1,952 | 6,445 | 21,617 | 18,525 | 4,421 | 58,682 |
| Iowa | 5,816 | 554 | 4,411 | 2,734 | 7,432 | 26,148 | 23,192 | 2,570 | 72,857 |
| Kansas | 3,451 | 705 | 1,080 | 857 | 4,078 | 20,854 | 13,801 | 5,595 | 50,421 |
| Kentucky | 6,963 | 645 | 651 | 0 | 0 | 18,374 | 1,065 | 1,064 | 28,762 |
| Louisiana | 4,661 | 414 | 589 | 581 | 601 | 23,704 | 9,418 | 3,284 | 43,252 |
| Maine | 2,232 | 279 | 573 | 539 | 743 | 5,715 | 2,793 | 459 | 13,333 |
| Maryland | 3,383 | 868 | 896 | 239 | 2,852 | 12,977 | 4,253 | 544 | 26,012 |
| Massachusetts | 2,283 | 809 | 2,441 | 357 | 1,468 | 3,180 | 6,581 | 471 | 17,590 |
| Michigan | 4,991 | 1,733 | 4,611 | 3,271 | 10,358 | 26,354 | 22,634 | 2,708 | 76,660 |
| Minnesota | 5,164 | 423 | 828 | 2,343 | 2,855 | 34,714 | 18,323 | 5,048 | 69,698 |
| Mississippi | 5,927 | 137 | 3,125 | 1,888 | 941 | 16,165 | 9,246 | 2,128 | 39,557 |
| Missouri | 6,673 | 616 | 560 | 607 | 2,511 | 19,580 | 10,340 | 4,008 | 44,895 |
| Montana | 2,372 | 380 | 442 | 743 | 2,909 | 8,013 | 6,928 | 1,653 | 23,440 |
| Nebraska | 3,347 | 541 | 1,252 | 3,470 | 2,903 | 23,384 | 19,099 | 12,177 | 66,173 |
| Nevada | 1,191 | 339 | 51 | 50 | 982 | 4,014 | 2,266 | 634 | 9,527 |
| New Hampshire | 1,620 | 118 | 0 | 0 | 11 | 2,468 | 314 | 289 | 4,820 |
| New Jersey | 2,763 | 393 | 710 | 298 | 2,184 | 12,985 | 6,182 | 0 | 25,515 |
| New Mexico | 1,724 | 0 | 484 | 1,115 | 405 | 7,414 | 1,193 | 171 | 12,506 |
| New York | 5,945 | 3,165 | 2,468 | 2,298 | 18,404 | 4,4031 | 53,084 | 15,318 | 144,713 |
| No. Carolina | 9,179 | 1,713 | 348 | 2,996 | 7,960 | 36,791 | 22,041 | 1,580 | 82,608 |
| North Dakota | 2,308 | 27 | 2,313 | 852 | 1,529 | 12,981 | 7,295 | 2,725 | 30,030 |
| Ohio | 5,716 | 785 | 1,410 | 522 | 2,874 | 20,912 | 10,640 | 1,687 | 44,546 |
| Oklahoma | 4,333 | 364 | 1,145 | 476 | 1,282 | 16,276 | 6,540 | 360 | 30,776 |
| Oregon | 3,314 | 1,135 | 2,842 | 4,307 | 9,958 | 18,320 | 11,654 | 3,516 | 55,046 |
| Pennsylvania | 6,177 | 1,202 | 1,246 | 1,371 | 6,563 | 19,538 | 14,677 | 76 | 50,850 |
| Rhode Island | 1,238 | 73 | 0 | 0 | 390 | 1,663 | 460 | 0 | 3,824 |
| So. Carolina | 4,923 | 253 | 576 | 461 | 1,172 | 20,279 | 4,755 | 96 | 32,515 |
| South Dakota | 2,452 | 105 | 114 | 69 | 286 | 6,457 | 4,764 | 3,973 | 18,220 |
| Tennessee | 6,414 | 669 | 679 | 228 | 609 | 14,015 | 4,902 | 3,114 | 30,630 |
| Texas | 9,175 | 4,769 | 7,285 | 4,586 | 10,954 | 53,664 | 32,549 | 8,370 | 131,352 |
| Utah | 1,818 | 375 | 157 | 998 | 2,817 | 7,294 | 6,219 | 353 | 20,031 |
| Vermont | 1,600 | 37 | 45 | 1,220 | 319 | 2,211 | 1,212 | 5 | 6,649 |
| Virginia | 5,991 | 39 | 62 | 2,071 | 5,254 | 22,183 | 13,701 | 0 | 49,301 |
| Washington | 4,104 | 1,161 | 2,250 | 2,405 | 6,076 | 22,707 | 22,608 | 2,103 | 63,414 |
| W. Virginia | 2,824 | 194 | 355 | 667 | 348 | 3,258 | 1,234 | 529 | 9,409 |
| Wisconsin | 5,223 | 2,525 | 932 | 741 | 18,620 | 26,324 | 29,357 | 0 | 83,722 |
| Wyoming | 1,670 | 162 | 38 | 243 | 256 | 3,591 | 526 | 0 | 6,486 |
| Amer. Somoa | 641 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 641 |
| Dist. Col. | 498 | 86 | 0 | 0 | 0 | 307 | 15 | 0 | 906 |
| Guam | 781 | 0 | 230 | 0 | 0 | 1,664 | 0 | 0 | 2,675 |
| N Marianas | 454 | 0 | 0 | 0 | 0 | 0 | 121 | 0 | 575 |
| Puerto Rico | 3,873 | 6 | 377 | 0 | 0 | 6,397 | 751 | 752 | 12,156 |
| Virgin Islnds | 736 | 0 | 139 | 0 | 0 | 464 | 0 | 0 | 1,339 |
| Total | 209,409 | 40,045 | 61,910 | 65,980 | 221,320 | 981,490 | 601,887 | 116,108 | 2,298,149 |
| % of Total to States | 9.11% | 1.74% | 2.69% | 2.87% | 9.63% | 42.71% | 26.19% | 5.05% | 100.0% |

[a]includes private foundations. [b]Totals may not add up exactly due to rounding.

Source: USDA, 1992 Inventory of Agricultural Research.

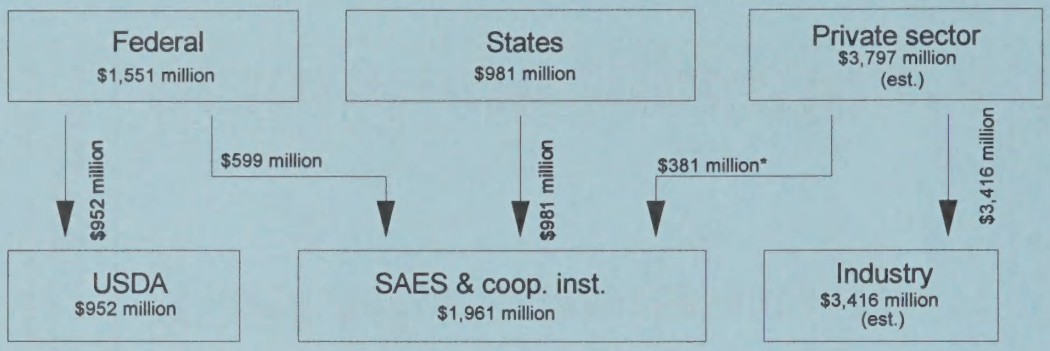
Table 2--Total private sector research expenditures on agriculture, by category 1960-1992 (million current $)

| | Plant breeding | | Agricultural chemicals | | Farm machinery | | Animal health | | Total agric. inputs | | Food & kindred products | | Total private ag. R&D | R&D deflator |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (1980$) |
| 1960 | 6 | 3 | 27 | 13 | 75 | 36 | 6 | 3 | 114 | 55 | 92 | 45 | 206 | .3332 |
| 1961 | 6 | 3 | 38 | 18 | 65 | 31 | 11 | 5 | 120 | 57 | 92 | 43 | 212 | .3429 |
| 1962 | 6 | 3 | 42 | 18 | 70 | 30 | 14 | 6 | 132 | 57 | 98 | 43 | 230 | .3574 |
| 1963 | 7 | 3 | 45 | 18 | 76 | 31 | 15 | 6 | 143 | 58 | 102 | 42 | 245 | .3724 |
| 1964 | 8 | 3 | 48 | 18 | 79 | 29 | 20 | 7 | 155 | 57 | 118 | 43 | 273 | .3865 |
| 1965 | 9 | 3 | 64 | 20 | 96 | 30 | 23 | 7 | 192 | 59 | 131 | 41 | 323 | .4027 |
| 1966 | 11 | 3 | 77 | 22 | 100 | 29 | 28 | 8 | 216 | 62 | 130 | 38 | 346 | .4229 |
| 1967 | 12 | 3 | 72 | 20 | 102 | 29 | 35 | 10 | 221 | 62 | 134 | 38 | 355 | .4468 |
| 1968 | 17 | 4 | 78 | 20 | 96 | 25 | 36 | 9 | 227 | 58 | 165 | 42 | 392 | .4736 |
| 1969 | 22 | 5 | 85 | 20 | 99 | 24 | 34 | 8 | 239 | 57 | 182 | 43 | 421 | .5049 |
| 1970 | 26 | 6 | 98 | 21 | 89 | 19 | 45 | 10 | 258 | 56 | 206 | 44 | 464 | .5425 |
| 1971 | 29 | 6 | 109 | 22 | 90 | 18 | 48 | 10 | 276 | 57 | 211 | 43 | 487 | .5729 |
| 1972 | 32 | 6 | 104 | 20 | 93 | 18 | 52 | 10 | 280 | 55 | 227 | 45 | 507 | .5990 |
| 1973 | 39 | 7 | 113 | 20 | 120 | 21 | 62 | 11 | 333 | 58 | 243 | 42 | 576 | .6346 |
| 1974 | 45 | 7 | 136 | 20 | 131 | 20 | 74 | 11 | 386 | 58 | 283 | 42 | 669 | .6832 |
| 1975 | 50 | 7 | 169 | 24 | 138 | 19 | 79 | 11 | 436 | 61 | 273 | 39 | 709 | .7337 |
| 1976 | 55 | 7 | 200 | 24 | 168 | 21 | 87 | 11 | 510 | 62 | 308 | 38 | 818 | .7800 |
| 1977 | 58 | 6 | 243 | 25 | 221 | 23 | 84 | 9 | 606 | 64 | 348 | 36 | 954 | .8107 |
| 1978 | 69 | 6 | 290 | 27 | 249 | 23 | 86 | 8 | 694 | 64 | 385 | 36 | 1079 | .8601 |
| 1979 | 81 | 7 | 312 | 26 | 295 | 25 | 96 | 8 | 784 | 65 | 420 | 35 | 1204 | .9225 |
| 1980 | 97 | 7 | 395 | 27 | 363 | 25 | 111 | 8 | 965 | 66 | 488 | 34 | 1453 | 1.0000 |
| 1981 | 105 | 7 | 469 | 32 | 278 | 19 | 125 | 9 | 976 | 66 | 492 | 34 | 1468 | 1.0883 |
| 1982 | 118 | 7 | 527 | 32 | 281 | 17 | 129 | 8 | 1055 | 64 | 596 | 36 | 1652 | 1.1732 |
| 1983 | 138 | 8 | 584 | 33 | 290 | 16 | 147 | 8 | 1158 | 65 | 636 | 35 | 1794 | 1.2396 |
| 1984 | 154 | 8 | 624 | 30 | 311 | 15 | 154 | 8 | 1243 | 61 | 803 | 39 | 2046 | 1.3114 |
| 1985 | 179 | 8 | 683 | 32 | 304 | 14 | 159 | 7 | 1326 | 61 | 842 | 39 | 2167 | 1.3853 |
| 1986 | 204 | 9 | 691 | 30 | 307 | 13 | 179 | 8 | 1381 | 60 | 940 | 40 | 2321 | 1.4650 |
| 1987 | 222 | 10 | 682 | 30 | 292 | 13 | 191 | 8 | 1388 | 61 | 891 | 39 | 2278 | 1.5546 |
| 1988 | 245 | 9 | 938 | 36 | 295 | 11 | 221 | 9 | 1699 | 66 | 884 | 34 | 2583 | 1.6215 |
| 1989 | 283 | 10 | 979 | 35 | 320 | 12 | 243 | 9 | 1825 | 66 | 947 | 34 | 2772 | 1.7156 |
| 1990 | 314 | 10 | 1127 | 37 | 360 | 12 | 245 | 8 | 2046 | 68 | 965 | 32 | 3012 | 1.8049 |
| 1991 | 342 | 11 | 1227 | 39 | 382 | 12 | 276 | 9 | 2227 | 70 | 946 | 30 | 3173 | 1.8842 |
| 1992 | 400 | 12 | 1279 | 37 | 394 | 12 | 306 | 9 | 2379 | 70 | 1038 | 30 | 3416 | 1.9497 |

* Numbers may not add due to rounding. The estimate of the total investment in agricultural research by the private sector is conservative, and may have been as much as $200 to $300 million more in 1992, due to lack of data on research investment in animal breeding, biotechnology, and other areas. Annual expenditures have been adjusted for inflation by the R&D deflator, a price index which accounts for inflation in the cost of research inputs. The costs of conducting research have risen faster than the rate of inflation, especially during the 1980's.

Source: USDA, ERS, unpublished data.

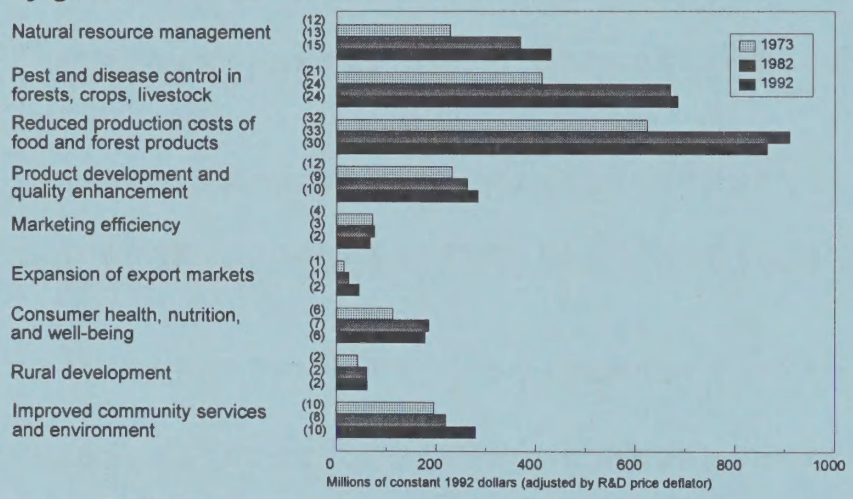
## Figure 2 -- Sources and flows of funding for agricultural research, 1992




*Includes $143 million from private industry, $116 million from product sales, and $121 million from private foundations and other sources.

Sources: USDA; 1992 Inventory of Agricultural Research; and USDA, ERS, unpublished data.

## Figure 3 -- Allocation of USDA - SAES research expenditures by goal




Percentages of total expenditures for that year in parenthesis (may not sum to 100 due to rounding).

Source: USDA, Inventory of Agricultural Reseach.

AREI UPDATES
Natural Resources and Environment Division
1301 New York Avenue, NW, Room 524
Washington, DC 20005-4788

# Revised
# AREI UPDATE

The enclosed UPDATE on Agricultural Research replaces the original UPDATE, 1995 number 5, with the same title. Please discard the original. The revised UPDATE reflects corrected data in table 1 for the "Industry/other" and "Total" columns and the "% of total to States" row.

# AREI UPDATES: Agricultural Research

***Updates on Agricultural Resources and Environmental Indicators***

Natural Resources and Environment Division
Economic Research Service, U.S. Department of Agriculture

1995
Number 5 Revised

## Private Research Continued Faster Growth than Public Research in 1992

- **The private sector spent more than $3.7 billion for research on food and agriculture in 1992, compared with Federal expenditures of $1.5 billion and state government expenditures of $0.98 billion.**

- **Over 38% of Federal expenditures for agricultural research in 1992 went to State Agricultural Experiment Stations (SAES) and cooperating institutions.**

- **Private expenditures for agricultural research have been increasingly directed to agricultural chemicals research, rising from 13% of the total in 1960 to 37% in 1992, and to plant breeding research, rising from 3% in 1960 to 12% in 1992.**

- **USDA grants in 1992 to SAES in the form of formula funds, competitive grants, special grants, and cooperative agreements funded 19% of SAES research.**

Since the 1980's, the private sector has surpassed the public sector in agricultural research expenditures. Private industry also provided $143 million in funds to SAES and cooperating institutions in 1992.

Research by agricultural inputs industries has grown faster than that by food and kindred products industries. Within input industries, research on chemical and biological innovations has grown faster than that for mechanical innovations.

The distribution of public research expenditures across research goals has not changed markedly since 1973. Goals of cost reduction, pest and disease protection, and natural resource management accounted for 69% of the total in 1992.

SAES receive research funds from multiple sources, and individual states vary widely with respect to their reliance on alternative funding sources. Overall, state appropriations are the major source of SAES funds, followed by the Federal government, and then industry and other non-governmental sources.

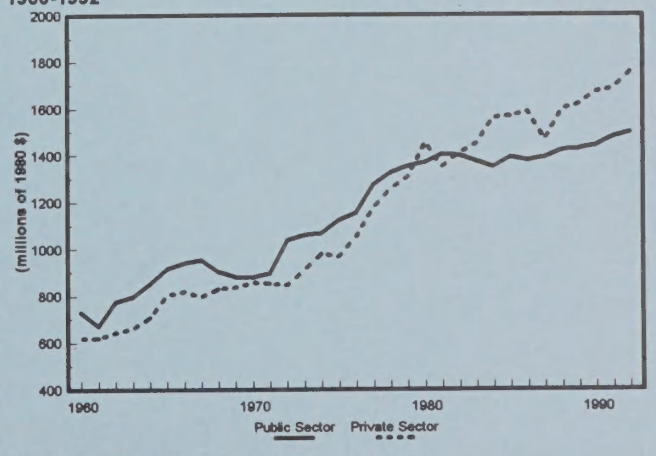
Texas is the largest recipient of USDA grants, ranking either first or second in each category. Ten states rely on USDA formula funds for over 74% of their USDA grants. USDA competitive grants are only 1.7% of total funds to SAES. California, Texas, New York, and Wisconsin are the leading recipients of competitive grants.

Contacts: Keith Fuglie (202) 219-1263, Kelly Day (202) 219-0331, George Frisvold (202) 219-0416, or Cassandra Klotz (202) 219-0443.

### About AREI UPDATES

**AREI UPDATES** is a periodic series which supplements and updates information in **Agricultural Resources and Environmental Indicators (AREI)**, USDA, ERS, AH-705, Dec. 1994. **UPDATES** report recent data from surveys of farm operators and others knowledgeable about changing agricultural resource use and conditions, with only minimal interpretation or analysis. Please contact the individual listed at the end of the text for additional information about the data in this **UPDATE**. If you would like to be added to the mailing list or have other questions about **AREI UPDATES** or **AREI**, contact Richard Magleby, (202) 219-0436.

**Figure 1 – Expenditures for agricultural research in the U.S., 1960-1992**




Expenditures deflated by R&D price deflator (see table 2).
Source: USDA, Inventory of Agricultural Research; and ERS, unpublished data.

Table 1--Funding of State agricultural experiment stations and cooperating research institutions, by funding source, 1992

| | USDA formula funds | USDA competitive grants | USDA special grants | Other USDA grants | Other Federal grants | State appropriations | Industry/ other[a] | Product sales | Total[b] |
|---|---|---|---|---|---|---|---|---|---|
| | Thousands 1992 dollars | | | | | | | | |
| Alabama | 7,361 | 516 | 887 | 758 | 1,356 | 19,883 | 3,642 | 4,115 | 38,518 |
| Alaska | 1,269 | 0 | 80 | 0 | 512 | 3,473 | 407 | 0 | 5,741 |
| Arizona | 2,083 | 746 | 82 | 2,157 | 8,246 | 20,293 | 4,405 | 1,668 | 39,680 |
| Arkansas | 5,116 | 83 | 2,598 | 854 | 942 | 18,148 | 5,377 | 0 | 33,118 |
| California | 5,674 | 4,996 | 1,806 | 4,162 | 26,420 | 107,276 | 17,875 | 3,401 | 171,610 |
| Colorado | 3,028 | 567 | 465 | 3,084 | 20,095 | 8,862 | 7,283 | 8,055 | 51,439 |
| Connecticut | 1,879 | 129 | 436 | 442 | 683 | 6,055 | 1,171 | 56 | 10,851 |
| Delaware | 1,819 | 74 | 65 | 196 | 242 | 5,057 | 2,119 | 446 | 10,018 |
| Florida | 4,391 | 1,539 | 2,156 | 1,866 | 8,071 | 61,460 | 13,910 | 0 | 93,393 |
| Georgia | 6,764 | 1,128 | 968 | 1,347 | 1,806 | 40,138 | 4,569 | 0 | 56,720 |
| Hawaii | 1,309 | 84 | 2,668 | 1,308 | 2,337 | 12,897 | 2,367 | 43 | 23,401 |
| Idaho | 2,370 | 162 | 907 | 1,465 | 860 | 11,606 | 2,263 | 1,046 | 20,679 |
| Illinois | 5,459 | 1,711 | 805 | 786 | 4,401 | 17,355 | 10,949 | 5,109 | 46,575 |
| Indiana | 4,939 | 511 | 272 | 1,952 | 6,445 | 21,617 | 7,657 | 4,421 | 47,814 |
| Iowa | 5,816 | 554 | 4,411 | 2,734 | 7,432 | 26,148 | 13,190 | 2,570 | 62,855 |
| Kansas | 3,451 | 705 | 1,080 | 857 | 4,078 | 20,854 | 4,130 | 5,595 | 40,750 |
| Kentucky | 6,963 | 645 | 651 | 0 | 0 | 18,374 | 0 | 1,064 | 27,697 |
| Louisiana | 4,661 | 414 | 589 | 581 | 601 | 23,704 | 5,532 | 3,284 | 39,366 |
| Maine | 2,232 | 279 | 573 | 539 | 743 | 5,715 | 1,591 | 459 | 12,131 |
| Maryland | 3,383 | 868 | 896 | 239 | 2,852 | 12,977 | 857 | 544 | 22,616 |
| Massachusetts | 2,283 | 809 | 2,441 | 357 | 1,468 | 3,180 | 4,641 | 471 | 15,650 |
| Michigan | 5,157 | 1,758 | 4,637 | 3,271 | 10,448 | 26,354 | 9,263 | 2,708 | 63,596 |
| Minnesota | 5,164 | 423 | 828 | 2,343 | 2,855 | 34,714 | 10,421 | 5,048 | 61,796 |
| Mississippi | 5,927 | 137 | 3,125 | 1,888 | 941 | 16,165 | 6,175 | 2,128 | 36,486 |
| Missouri | 6,673 | 616 | 560 | 607 | 2,511 | 19,580 | 3,820 | 4,008 | 38,375 |
| Montana | 2,372 | 380 | 442 | 743 | 2,909 | 8,013 | 2,365 | 1,653 | 18,877 |
| Nebraska | 3,347 | 541 | 1,252 | 3,470 | 2,903 | 23,384 | 4,018 | 12,177 | 51,092 |
| Nevada | 1,191 | 339 | 51 | 50 | 982 | 4,014 | 648 | 634 | 7,909 |
| New Hampshire | 1,620 | 118 | 0 | 0 | 11 | 2,468 | 16 | 289 | 4,522 |
| New Jersey | 2,763 | 393 | 710 | 298 | 2,184 | 12,985 | 3,997 | 0 | 23,330 |
| New Mexico | 1,724 | 0 | 484 | 1,115 | 405 | 7,414 | 618 | 171 | 11,931 |
| New York | 5,779 | 3,140 | 2,444 | 2,298 | 18,314 | 44,031 | 19,668 | 15,318 | 110,992 |
| No. Carolina | 9,179 | 1,713 | 348 | 2,996 | 7,960 | 36,791 | 12,502 | 1,580 | 73,069 |
| North Dakota | 2,308 | 27 | 2,313 | 852 | 1,529 | 12,981 | 3,041 | 2,725 | 25,776 |
| Ohio | 5,716 | 785 | 1,410 | 522 | 2,874 | 20,912 | 6,079 | 1,687 | 39,985 |
| Oklahoma | 4,333 | 364 | 1,145 | 476 | 1,282 | 16,276 | 4,898 | 360 | 29,134 |
| Oregon | 3,314 | 1,135 | 2,842 | 4,307 | 9,958 | 18,320 | 5,275 | 3,516 | 53,214 |
| Pennsylvania | 6,177 | 1,202 | 1,246 | 1,371 | 6,563 | 19,538 | 8,039 | 76 | 44,212 |
| Rhode Island | 1,238 | 73 | 0 | 0 | 390 | 1,663 | 71 | 0 | 3,435 |
| So. Carolina | 4,923 | 253 | 576 | 461 | 1,172 | 20,279 | 3,489 | 96 | 31,249 |
| South Dakota | 2,452 | 105 | 114 | 69 | 286 | 6,457 | 505 | 3,973 | 13,961 |
| Tennessee | 6,414 | 669 | 679 | 228 | 609 | 14,015 | 1,181 | 3,114 | 26,909 |
| Texas | 9,175 | 4,769 | 7,285 | 4,586 | 10,954 | 53,664 | 13,225 | 8,370 | 112,028 |
| Utah | 1,818 | 375 | 157 | 998 | 2,817 | 7,294 | 3,048 | 353 | 16,860 |
| Vermont | 1,600 | 37 | 45 | 1,220 | 319 | 2,211 | 889 | 5 | 6,326 |
| Virginia | 5,991 | 39 | 62 | 2,071 | 5,254 | 22,183 | 8,448 | 0 | 44,048 |
| Washington | 4,104 | 1,161 | 2,250 | 2,405 | 6,076 | 22,707 | 7,335 | 2,103 | 43,594 |
| W. Virginia | 2,824 | 194 | 355 | 667 | 348 | 3,258 | 357 | 529 | 8,532 |
| Wisconsin | 5,223 | 2,525 | 932 | 741 | 18,620 | 26,324 | 10,735 | 0 | 65,100 |
| Wyoming | 1,670 | 162 | 38 | 243 | 256 | 3,591 | 270 | 0 | 6,230 |
| Amer. Somoa | 641 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 641 |
| Dist. Col. | 498 | 86 | 0 | 0 | 0 | 307 | 15 | 0 | 906 |
| Guam | 781 | 0 | 230 | 0 | 0 | 1,664 | 0 | 0 | 2,675 |
| N Marianas | 454 | 0 | 0 | 0 | 0 | 0 | 120 | 0 | 574 |
| Puerto Rico | 3,873 | 6 | 377 | 0 | 0 | 6,397 | 0 | 752 | 11,405 |
| Virgin Islnds | 736 | 0 | 139 | 0 | 0 | 464 | 0 | 0 | 1,339 |
| Total | 209,409 | 40,045 | 61,912 | 65,980 | 221,320 | 981,490 | 264,466 | 116,108 | 1,960,730 |
| % of Total to States | 10.68% | 2.04% | 3.16% | 3.37% | 11.29% | 50.06% | 13.49% | 5.92% | 100.00% |

[a]Includes private foundations. [b]Totals may not add up exactly due to rounding.
Source: USDA, 1992 Inventory of Agricultural Research, series IV tables.

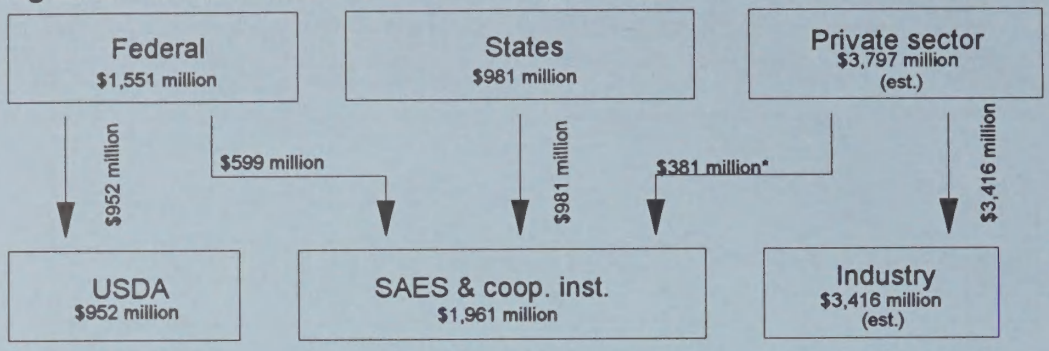
Table 2--Total private sector research expenditures on agriculture, by category 1960-1992 (million current $)

| | Plant breeding | | Agricultural chemicals | | Farm machinery | | Animal health | | Total agric. inputs | | Food & kindred products | | Total private ag. R&D | R&D deflator |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (%) | ($) | (1980$) |
| 1960 | 6 | 3 | 27 | 13 | 75 | 36 | 6 | 3 | 114 | 55 | 92 | 45 | 206 | .3332 |
| 1961 | 6 | 3 | 38 | 18 | 65 | 31 | 11 | 5 | 120 | 57 | 92 | 43 | 212 | .3429 |
| 1962 | 6 | 3 | 42 | 18 | 70 | 30 | 14 | 6 | 132 | 57 | 98 | 43 | 230 | .3574 |
| 1963 | 7 | 3 | 45 | 18 | 76 | 31 | 15 | 6 | 143 | 58 | 102 | 42 | 245 | .3724 |
| 1964 | 8 | 3 | 48 | 18 | 79 | 29 | 20 | 7 | 155 | 57 | 118 | 43 | 273 | .3865 |
| 1965 | 9 | 3 | 64 | 20 | 96 | 30 | 23 | 7 | 192 | 59 | 131 | 41 | 323 | .4027 |
| 1966 | 11 | 3 | 77 | 22 | 100 | 29 | 28 | 8 | 216 | 62 | 130 | 38 | 346 | .4229 |
| 1967 | 12 | 3 | 72 | 20 | 102 | 29 | 35 | 10 | 221 | 62 | 134 | 38 | 355 | .4468 |
| 1968 | 17 | 4 | 78 | 20 | 96 | 25 | 36 | 9 | 227 | 58 | 165 | 42 | 392 | .4736 |
| 1969 | 22 | 5 | 85 | 20 | 99 | 24 | 34 | 8 | 239 | 57 | 182 | 43 | 421 | .5049 |
| 1970 | 26 | 6 | 98 | 21 | 89 | 19 | 45 | 10 | 258 | 56 | 206 | 44 | 464 | .5425 |
| 1971 | 29 | 6 | 109 | 22 | 90 | 18 | 48 | 10 | 276 | 57 | 211 | 43 | 487 | .5729 |
| 1972 | 32 | 6 | 104 | 20 | 93 | 18 | 52 | 10 | 280 | 55 | 227 | 45 | 507 | .5990 |
| 1973 | 39 | 7 | 113 | 20 | 120 | 21 | 62 | 11 | 333 | 58 | 243 | 42 | 576 | .6346 |
| 1974 | 45 | 7 | 136 | 20 | 131 | 20 | 74 | 11 | 386 | 58 | 283 | 42 | 669 | .6832 |
| 1975 | 50 | 7 | 169 | 24 | 138 | 19 | 79 | 11 | 436 | 61 | 273 | 39 | 709 | .7337 |
| 1976 | 55 | 7 | 200 | 24 | 168 | 21 | 87 | 11 | 510 | 62 | 308 | 38 | 818 | .7800 |
| 1977 | 58 | 6 | 243 | 25 | 221 | 23 | 84 | 9 | 606 | 64 | 348 | 36 | 954 | .8107 |
| 1978 | 69 | 6 | 290 | 27 | 249 | 23 | 86 | 8 | 694 | 64 | 385 | 36 | 1079 | .8601 |
| 1979 | 81 | 7 | 312 | 26 | 295 | 25 | 96 | 8 | 784 | 65 | 420 | 35 | 1204 | .9225 |
| 1980 | 97 | 7 | 395 | 27 | 363 | 25 | 111 | 8 | 965 | 66 | 488 | 34 | 1453 | 1.0000 |
| 1981 | 105 | 7 | 469 | 32 | 278 | 19 | 125 | 9 | 976 | 66 | 492 | 34 | 1468 | 1.0883 |
| 1982 | 118 | 7 | 527 | 32 | 281 | 17 | 129 | 8 | 1055 | 64 | 596 | 36 | 1652 | 1.1732 |
| 1983 | 138 | 8 | 584 | 33 | 290 | 16 | 147 | 8 | 1158 | 65 | 636 | 35 | 1794 | 1.2396 |
| 1984 | 154 | 8 | 624 | 30 | 311 | 15 | 154 | 8 | 1243 | 61 | 803 | 39 | 2046 | 1.3114 |
| 1985 | 179 | 8 | 683 | 32 | 304 | 14 | 159 | 7 | 1326 | 61 | 842 | 39 | 2167 | 1.3853 |
| 1986 | 204 | 9 | 691 | 30 | 307 | 13 | 179 | 8 | 1381 | 60 | 940 | 40 | 2321 | 1.4650 |
| 1987 | 222 | 10 | 682 | 30 | 292 | 13 | 191 | 8 | 1388 | 61 | 891 | 39 | 2278 | 1.5546 |
| 1988 | 245 | 9 | 938 | 36 | 295 | 11 | 221 | 9 | 1699 | 66 | 884 | 34 | 2583 | 1.6215 |
| 1989 | 283 | 10 | 979 | 35 | 320 | 12 | 243 | 9 | 1825 | 66 | 947 | 34 | 2772 | 1.7156 |
| 1990 | 314 | 10 | 1127 | 37 | 360 | 12 | 245 | 8 | 2046 | 68 | 965 | 32 | 3012 | 1.8049 |
| 1991 | 342 | 11 | 1227 | 39 | 382 | 12 | 276 | 9 | 2227 | 70 | 946 | 30 | 3173 | 1.8842 |
| 1992 | 400 | 12 | 1279 | 37 | 394 | 12 | 306 | 9 | 2379 | 70 | 1038 | 30 | 3416 | 1.9497 |

* Numbers may not add due to rounding. The estimate of the total investment in agricultural research by the private sector is conservative, and may have been as much as $200 to $300 million more in 1992, due to lack of data on research investment in animal breeding, biotechnology, and other areas. Annual expenditures have been adjusted for inflation by the R&D deflator, a price index which accounts for inflation in the cost of research inputs. The costs of conducting research have risen faster than the rate of inflation, especially during the 1980's.

Source: USDA, ERS, unpublished data.

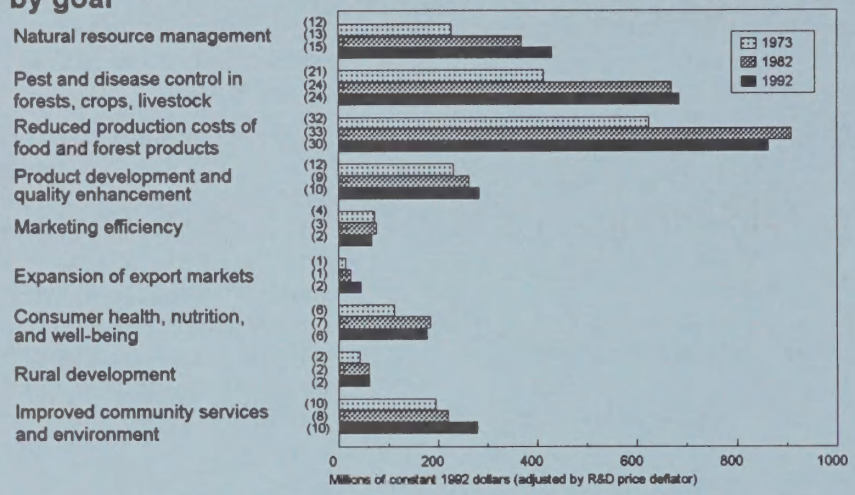
## Figure 2 -- Sources and flows of funding for agricultural research, 1992




*Includes $143 million from private industry, $116 million from product sales, and $121 million from private foundations and other sources.

Sources: USDA; 1992 Inventory of Agricultural Research; and USDA, ERS, unpublished data.

## Figure 3 -- Allocation of USDA - SAES research expenditures by goal




Percentages of total expenditures for that year in parenthesis (may not sum to 100 due to rounding).

Source: USDA, Inventory of Agricultural Reseach.

U.S. Department of Agriculture
Economic Research Service

SUMMARY OF REPORT #AIB-716

# Mix of Incentives Encourages Farmers to Adopt Water Quality Practices

May 1995

*Contact: Peter M. Feather, (202) 501-8357, or Joseph Cooper, (202) 501-6970*

Agricultural chemicals and sediment from cropland may reduce the quality of America's surface and ground water resources. The Clean Water Act stipulates that individual States are responsible for controlling agricultural nonpoint source pollution. Most State plans rely chiefly on education and technical assistance to promote less polluting practices. A new report from USDA's Economic Research Service, *Voluntary Incentives for Reducing Agricultural Nonpoint Source Water Pollution*, presents recent research findings on the success of existing incentive practices to control agricultural nonpoint source pollution. Because profitability drives production decisions, these programs tend to be most successful when they promote inexpensive changes in existing practices.

Impaired surface water quality from cropland erosion alone has resulted in $2-$8 billion in annual losses to recreational and commercial fishing, boating, municipal treatment plants, water storage facilities, and navigable waterways. Both voluntary and mandatory policies have been implemented and studied to reduce agricultural pollution. Voluntary incentives rely on providing the farm operator with an incentive to adopt less polluting technologies. These approaches commonly use cost-sharing or education and technical assistance to encourage farm operators to use less polluting practices. Regulations or taxes to force farm operators to reduce pollution levels are two examples of mandatory approaches.

Because nonpoint source pollution is not directly measurable, regulations would consist of design standards governing farmers' land management and cropping practices. Although this option may appear to be a simple solution, administrative costs may be high. When taxes are levied on a polluting input (such as a chemical pesticide), farmers will reduce their use of that input and substitute other, less polluting inputs to reduce costs. The extent of the change in input use depends on the sensitivity of the demand for the polluting input to price changes, which can change from one area to another.

Education, Technical, and Financial Assistance, a component of the U.S. Department of Agriculture's (USDA) Water Quality Program, is a national effort to encourage the adoption of less polluting farm management practices. Research findings indicate that the adoption of an improved management practice is most strongly influenced by producer perceptions of its effect on profitiability. Other important factors include familiarity with the practice and beliefs that it will improve onfarm water quality. This indicates that educational programs are best targeted toward inexpensive, familiar practices with tangible environmental benefits.

The 1990 Food, Agriculture, Conservation, and Trade Act authorized USDA to create the watershed-based Water Quality Incentive Program (WQIP). WQIP encouraged the adoption of less polluting practices via direct incentive payments to farmers. The findings in this report suggest that the adoption of some less polluting practices is highly influenced by the payment level, while the adoption of others is not. Payments that are too low will have little effect on adoption, while those that are too high will result in the same level of adoption that could be accomplished by a lower payment. These findings suggest that WQIP payments should reflect changes in costs of production due to the adoption of an improved management practice.

## To Order This Report...

The information presented here is excerpted from ***Voluntary Incentives for Reducing Agricultural Nonpoint Source Water Pollution,*** AIB-716, by Peter M. Feather and Joseph Cooper. The cost is $7.50.

To order, dial **1-800-999-6779** (toll free in the United States and Canada) and ask for the report by title.

Please add 25 percent to foreign addresses (including Canada). Charge to VISA or MasterCard. Or send a check (made payable to ERS-NASS) to:

ERS-NASS
341 Victory Drive
Herndon, VA 22070.

We'll fill your order by first-class mail.

AREI UPDATES
Natural Resources and Environment Division
1301 New York Ave., NW., Rm. 524
Washington, DC 20005-4788